THE AMERICAN JOURNAL OF

OPHTHALMOLOGY.

VOL. XII. SEPTEMBER, 1895. NO. 9.

ORIGINAL ARTICLES.

NEURITIS OPTICA DESCENDENS CONSEQUENT UPON NASAL TREATMENT.

BY ADOLF ALT, M.D., ST. LOUIS.

The readers of this journal will find in the June number of 1887 the translation of part of an article by Ziem, published originally in *Hirschberg's Centralblatt*, in which the author relates some cases, in which the use of the galvano-cautery in the nose had evidently induced some impairment of vision. In his experience this impairment of vision was combined with a venous pulsation on the papilla of the affected eye, general venous hyperæmia of the retina and, in one case, with an increase of the intra-ocular tension.

Ziem saw the cause of these ocular phenomena in the numerous anostomoses between the blood-vessels of the nasal cavity and of the orbit and eyeball (particularly the ethmoidales). He thought that the blood, which by means of the galvano-cautery is suddenly driven from the nasal tissues, escapes into the orbit and the eyeball, and there produces a hyperæmia,

which more particularly affects the erectile tissue of the ciliary body.

In an article on rarer forms of injury to the eye, published in the *Archives of Ophthalmology*, 1887, Berger relates a case in which the bunglingly performed galvano-cautery of the erectile tissue in the nose was followed by necrosis of the nasal bone, and by impaired vision, as if a thick mist was lying before the eye. He saw the patient when vision had almost returned to the normal. He found a normal fundus, but the field of vision in the affected right eye, was still concentrically narrower to from 10° to 15°, than in the fellow eye, and 5° more to the temporal side.

In his opinion the eye affection was due to an irritation of the trigeminus nerve and must be considered as a reflex amblyopia.

The only text-book which mentions anything on the subject, is, as far as I can find, that on the relations between the eye and its diseases to the diseases of the body and its organs, by M. Knies. Knies in referring to those cases says:

"More importance attaches to the cases of impaired vision following operative measures to the nasal mucous membrane (galvano-cautery), as reported by several authors It seems, that in such cases we have not infrequently to deal with the well known concentric contraction of the visual field with or without impairment of central vision and of color perception. The eye, corresponding to the side operated upon, is the only one or at least the one most impaired, and in all cases the affection is a transient one. All other pains or painful interferences in the neighborhood of the eye may occasionally act in a similar manner."

It seems then, (and I have seen two such cases, in my practice), that galvano-cautery applied to the nasal mucous membrane may produce a reflex amblyopia with narrowing of the field of vision, or an impairment of vision combined with or due to a hyperæmia of the eyeball, especially of the ciliary body.

The following case, which has just passed under my own

observation is of a somewhat different and undoubtedly more serious nature.

E. J. L., 38 years of age, consulted me September 7, with the following history: He had been treated for nasal catarrh and narrowing of the left nasal passage by means of different applications and of galvano-cautery. Two days before seeing me he noticed, that his left eye did not see as usual, but, although he mentioned this to the gentleman who treated the nose, the treatment was persisted in. When he awoke on the morning of September 7, he found his left eye to be totally blind. He came to me in great anxiety, because he could now hardly see daylight.

I found a more than medium widely dilated and scarcely moving pupil. Vision was reduced to a doubtful perception of light. The ophthalmoscope showed a papilla the outlines of which were almost invisible and a high degree of venous hyperæmia in the retina, combined with thin arteries. Tension was normal. The urine was found to be normal. Nothing pathological could be detected in other organs.

From the history as given by the patient, I did not doubt, but what this neuritis was due to the nasal treatment. I, therefore, advised a complete cessation of all treatment.

In doing this I hoped, that a cessation of all irritating interference would be followed by a speedy disappearance of the affection of the optic nerve. In this I was not altogether disappointed. On the third day the patient counted fingers eccentrically, up and outwards, at one foot. On the sixth day the field had considerably increased on the nasal and lower sides, and fingers were counted at five feet upwards and outwards, at four feet in the other parts of the field. As this condition remained the same for a few days I began to inject strychnia. This was followed by a much more rapid increase in vision and on the eighteenth day after I had first seen him he had regained a vision of $^{20}/_{xxx}$ +. The field of vision was still somewhat reduced in all directions except upwards and outwards. The veins appeared normal, but the arteries were

still thin and the papilla almost white. Color perception was normal.

In order to get a full history of the case, before I saw it, I requested Dr. H. Loeb, of this city, who had treated the nasal affection, to kindly furnish me with it, and the following is his reply:

"Mr. E. L., age 28 years, yard-master, consulted me first August 28, 1895, presenting the following symptoms: For several years he has suffered from obstruction of both sides of the nose; hawking, deafness, headache located over the frontal region. The deafness affects the left ear, the right being normal. Sense of smell is obtunded. He has had several accidents to his nose; had lues in 1889. He is accustomed to drink occasionally. Mother is still living, age 60; father died of paralysis at 49. Examination of the nose showed septum deflected to the left, with a sharp spur in the middle turbinated region, and chronic hypertrophy of both inferior turbinates. Removal of the spur and cauterization of the inferior turbinated were advised. Accordingly, on August 29, the left inferior turbinated was moderately cauterized. The following day there was some considerable swelling, not any unusual amount. The history of the following four days was the customary one. On September 2, I left the city, leaving the case in charge of my assistant, Dr. Sutton, who reported that during my absence nothing unusual occurred in the nose beyond a rather undue persistence of the swelling in the nose. Returning September 7, I found practically the condition that Dr. Sutton has described. A few days after this seemingly without any special reason the affection of the eye manifested itself, and he was accordingly referred to Dr. Alt. Subsequent examination revealed nothing unusual in the condition of the nose."

As the patient called to see me on the 7th, Dr. Loeb, in the last few sentences, evidently made a slight mistake.

From this letter, I for the first time learned the fact, that the patient had been infected with syphilis, and he now acknowledged it to me. It is, therefore, not impossible that in this case the severity of the attack was in some measure due

to the former syphilis. As however, no other symptom was present, as the eye-affection followed the nasal treatment, as it was confined to the eye corresponding to the side of the nose under treatment, and, finally—as the cessation of all nasal treatment was followed at once by a spontaneous, if at first slow, improvement—I think the syphilis can only be accused of an indirect cause in this trouble. It may have rendered the patient the more vulnerable and this may, perhaps, explain the severity of the affection.

Similar experiences should, I think, be made more widely known, as they are probably more numerous than would appear from the literature at my disposal.

SELECTIONS.

THE PATHOGENESIS OF SYMPATHETIC OPHTHALMIA.

BY LOUIS STRICKER, M.D., CINCINNATI.

No disease which presents itself to the oculist offers a more serious prognosis than sympathetic ophthalmia, for in the vast majority of cases it leads to total and incurable blindness. Rarely does the sympathizing eye escape with any useful vision. Hence this subject is an eminently practical one, because, necessarily, the treatment must be guided entirely by our conception of the pathogenesis of the disease.

Two theories have been promulgated, one that sympathetic ophthalmia is a neurosis, the other, that it is an infection; and finally, in 1892, a theory was set up stating that primarily it is a neurosis, the irritation creating a soil on which secondarily micro-organisms circulating in the blood find conditions favorable for their further development.

Naturally, as long as pathology taught that inflammation was the result of the action of sensitive and vaso-motor nerves on the capillaries, so long the cause of the inflammation in the second eye was looked upon as the result of the transference of ciliary nerve irritation to the second eye; but with the founding of a new principle, namely, that inflammation is the result of the action of micro-organisms, at present of their ptomaines or toxic products on the vessel walls, the investigators for the cause of sympathetic ophthalmia were forced to follow similar lines. However, notwithstanding the fact that for a number of years this disease was looked upon as the result of an infec-

tion, the student of the literature of the subject will find that many voices were again raised in favor of the ciliary nerve theory, and Deutschman's theory found but few champions at the Heidelberger Congress of 1891 and 1892. Since then more convincing proof has been published, which tends to strengthen the mycotic theory. Reasoning by anology, who to-day would doubt that syphilis or acute articular rheumatism are of microbic origin, or who to-day believes that an irregular incision made during a cataract extraction or the cicatrization of the iris will lead to sympathetic ophthalmia?

Schirmer[1] says: "The fact that inoculations of pieces of tissue taken from sympathetic eyes did not cause inflammation does not prove that bacteria were wanting, for rabbits are exceedingly refractory to the action of micro-organisms. Further, is it not possible that our methods are not sufficiently developed to prove their presence? It is illogical to doubt the bacterial nature of this disease, because we have not as yet proven a specific microbe. The many negative results simply indicate the difficulties in the way of acquiring a positive result."

As early as 1844 Mackenzie[2] developed three modes of transference of the disease from the one eye to the other:

1. *The propagation by means of the blood-vessels along the base of the brain.* He supposed that the vessels of the diseased eye, being in a state of congestion, this same condition was possibly transmitted to the vessels of the other side, with which they stood in connection by means of the circle of Willis.

2. By means of the ciliary nerves, being transferred by the third and fifth pair to the brain, here reflected to the opposite side and thence down to the second eye.

3. By direct propagation of the disease from the retina and optic nerve to the chiasm and then down the second optic nerve to the other eye. He considered the optic nerves as the principal means of transference.

In 1849 Mooren quotes Tavignot as stating that the primary trouble is a ciliary neurosis.

In 1858 Heinrich Müller[3] acknowledged the possibility of transference along the optic nerves, but since he frequently found the nerve atrophic, hence impossible of carrying impulses, he held it improbable; but, since he found that the ciliary nerves were but partially atrophic, some simply denuded of their myelin sheaths, he assumed that they were the carriers of the sympathetic process.

In 1862 Pagenstecher[4] denied the involvement of the optic nerves, and claimed that the transference was entirely due to the ciliary nerves, more especially the nutritive sympathetic fibres.

From now on opinions all began to coincide with the ciliary nerve theory, until finally, in 1881, Ludwig Mauthner[5] reviewed all the opinions and investigations which had been made up to that time. He was a staunch adherent of the ciliary nerve theory. He divided his cases into two classes, the traumatic and the non-traumatic. The non-traumatic he again divided into two classes:

1. *Those which result from the irritation of the uveal tract,* as per luxated lens, or intra-ocular cysts or tumors. He states, however, that all may have been preceded by a trauma.

2. *Those which result from pure uveal disease,* idiopathic cases of cyclitis or irido-choroiditis. Here, again, he adds that it is not an easy matter to determine whether the affection of the second eye is not the result of a general disease, as per example, syphilis or secondary to cerebro-spinal meningitis.

Hence, even he casts a doubt on all the non-traumatic cases. *The traumatic* he divides into the *operative* and the *accidental,* and *he further admits* that sympathetic disease *may follow without involvement of the ciliary body.*

He discusses two views at length. First, that the disease is propagated along the optic nerve apparatus, but since operation had proven time and again that in the second eye the anterior half of the globe is involved, the cause was sought in the ciliary nerves, some believing that the irritation is carried along the optic nerve, but in the sympathizing eye is transferred to the ciliary nerves, thus leading to the inflammation;

whereas, others believed that the irritation is carried from the ciliary nerves to the brain, reflected to the other side, and thus *directly*, by means of the ciliary nerves of the second eye, hence to a true ciliary neurosis.

Mauthner concludes that both the optic nerves and ciliary nerves may be the means of transference, the optic nerves propagating irritants and inflammatory conditions from the retina and optic nerve, whereas the ciliary nerves propagate similar conditions, which originate in the parts of the eye supplied by the ciliary nerves "There can be no doubt but that both modes of transference frequently occur at the same time, so that some symptoms may be ascribed to uveitis, others to neuro-retinitis."

However, the year previously to the publication of Mauthner's work, MacGillivary, at the International Congress held at Amsterdam, 1880, reported a case of sympathetic ophthalmia in which the microscopical examination of the enucleated eye, its optic nerve end sheath, disclosed conglomerations of cells between the pial and dural sheaths of the optic nerves. He stated the possibility of similar groups of cells in the lymph space within the cranial cavity, and also suggested the possibility of the inflammation being carried along this space surrounding the optic nerve.

The same year Berlin[6] stated that sympathetic ophthalmia (irido-choroiditis) is metastatic and infectious in its nature, the products of the infection being taken up by the general circulation, reach the second eye, where, finding similar conditions, they again become active.

During the same year Leber[7] expressed the hope that experience would yet prove the truth of the general proposition "that true sympathetic inflammation is an infection the result of a septic inflammation of the first eye." He emphatically insists on a separation between sympathetic neurosis and sympathetic inflammation. The same year at the International Congress, held in London, Snellen[8] spoke against the ciliary nerve theory, and came to the following conclusions:

1. That the ciliary nerve theory is wanting in even a single convincing proof.

2. That the disease is a specific form of septic choroiditis.

3. That in all probability the lymph space surrounding the optic nerve is the path along which the infection travels from one eye to the other.

In the meanwhile Deutschman had been carrying on his experimental investigations, his first publications appearing in *Graefe's Archiv.*, Vol. xxvii, Bd. 1, 1882 ("Experimentelle Erzeugung Sympathischer Ophthalmie"), and others followed in rapid succession in Vol. xxix, Bd. 4, 1883, and Vol. xxx, Bd. 3, 1884. All of which he again compiled in a monograph on the subject,[9] in which he critically analyzed all the literature on the subject. Stated as briefly as possible:

1. Injections of the spores of the aspergillus fumigatus into the eyes of rabbits produced an inflammation of the second eye. He noted not only an optic neuritis, but an inflammation of the entire uveal tract. Believing this to be *the result of a chemical irritant* derived from the mould, he injected croton oil and got a positive result.

Anatomical pathological examination showed a purulent inflammation of the affected eye, especially of the papilla, and it seemed to extend into the nerve and along its sheath and lymph space surrounding the nerve, from here to the chiasm, and then to a less degree it descended to the second eye, gradually increasing the intensity as it approached. *From this condition he concluded that the sub-vaginal lymph-space served as a path for the spread of the inflammation.*

2. He next made injections of pure cultures of the staphylococcus aureus and albus into the vitreous of the eyes of rabbits, which produced a chronic irido-cyclitis or choroiditis, ending in phthisis bulbi, followed in from five to six days by a beginning inflammation of the papilla of the second eye, when, without showing any signs of meningitis, the animals grew weak, emaciated, and died of *general sepsis*, without the development of iritis or cyclitis on the second eye. Inoculations of a few drops of the blood of these adimals on culture media de-

veloped pure cultures of the staphylococci, which further injected into animals proved exceedingly virulent.

3. In order to shorten the time until the disease should develop, he made injections into the nerve sheath close to the optic foramen, and on the following day the papilla on the same side was inflamed, and on the day following the vitreous was diffusely infiltrated and iritis began to develop. Hence he assumed that the micro-organisms had descended along the lymph space surrounding the nerve, and thus caused the inflammation of the uveal tract. Microscopicol examination showed the presence of staphylococci also extended toward the chiasm, and these would eventually have reached the second eye. *This lymph stream in the pial sheath is directed toward the globe, away from the brain, hence the microbes must work their way against the lymph stream up to the chiasm, from whence they are carried down to the second eye by the lymph stream.*

There being no anatomical difference between the optic nerve apparatus in man and animals, he concluded that the transference of the infection must proceed in the same manner in man. All that remained was to prove the truth of this hypothesis by the pathological examination of human eyes. In doing this he sought for three proofs or conditions:

1. Did eyes enucleated for existing or threathning sympathetic ophthalmia contain microbes?

2. Did a neuritis or peri-neuritis exist?

3. Were the germs pathogenic, and did the second eye contain pathogenic germs?

In an examination of twenty cases,[10] all except one showed the presence of micro-organisms, and in most of them they could also be demonstrated in the sub-vaginal lymph space. A papillitis was either present or evidences of the same were to be recognized.

The next link in the chain was to prove that the germs were pathogenic. In a series of nine cases, under the strictest antiseptic precautions, the eyes were opened immediately after enucleation, and inoculations of pus taken from the vitreous

were made on culture media. Every one of them showed the characteristic Rosenbach staphylococcus pyogenes aureus and albus. In five succeeding cases he not only carried out this procedure, but he drew off the aqueous from the second affected eye, inoculated this on culture media, and the growth of the micro-organisms showed the characteristics of those taken from the first eye. All showed, though somewhat attenuated, the characteristics of the staphylococcus pyogenes aureus and albus. The chain of evidence being complete. he concluded that *the pathogenic germs give rise to the inflammation, which travels along the lymph space to the second eye.*

These experiments mark an epoch, and changed the whole theory as to the cause of this affection.

These experimental investigations were taken up at the time by Alt,[11] of St. Louis, who, after a number of experiments with a 3 per cent. infusion of the abrus precatorius, succeeded in producing a sympathetic inflammation, and concluded that it must have gone along the lymph space to the second eye.

Gifford,[12] in 1886, did not have a single success in twenty-one cases in which he used the staphylococcus, but he succeeded in three out of four cases in which he used the tetanus bacillus. He was a great opponent of the sub-vaginal lymph-space theory, and states that the infection was neither carried along the optic nerve or its sheath, but along the central canal of the vitreous to the large blood-vessels of the optic nerve, thus getting entirely outside of the dural sheath, is carried by the lymphatics which surround the vessels through the sphenoidal fissure, until reaching the cranial cavity, from where, again, getting into the dural space and thus reaching the lymph space of the second eye.

Mazza,[13] in 1887, concludes that the micro-organisms are only found in the second eye in consequence of meningitis.

But neither Deutschman, Mazza nor Gifford succeeded in their numerous experiments in proving this migration without a general infection setting in.

Parisotti[14] succeeded in producing an infection of the second eye in eight out of thirty cases; of these, three died of a

general infection. In his five remaining cases the swelling of the papilla disappeared after a few days, and he is not inclined to look upon the staphylococci which he found in the chiasm, and even in the optic nerve of the second eye, as the cause of the inflammation, as he believes that they had lost their pathogenic qualities.

Both Limbourg and Levy[15] and Angelucci[16] have succeeded in raising pathogenic cocci from the aqueous and pieces of excised iris taken from the second eye; the objection has nevertheless been raised that as long as the experiments can not be successfully carried out on animals the success of all these experiments might be the result of an invasion of the cultures by microbes, an objection which was raised by Randolph[17] and Greef,[18] and all those who favor a nervous origin. This argument has received support in consequence of the negative results of others.

Schirmer,[19] however, notwithstanding a negative result in twelve experimental investigations, which were carried out exactly according to Deutschman's methods, expresses himself in favor of the bacteriological nature of this affection as opposed to a ciliary neuroses, giving as his reasons "(1) its exceptional power of propogation; (2) its severity and the frequency of relapses, which often occur even after an enucleation; (3) the total absence of any prodromal symptoms; (4) the short interval of three weeks having been sufficient for its development, even after an enucleation; (5) an eye must always suffer from an infectious uveal disease in order to be able to produce a second for which a mechanical irritation is not sufficient; and (6) it must not be forgotten that every evidence of a true progressive inflammation as the result of irritation of nerves is wanting."

Schirmer felt called upon to defend this theory, because voices were being raised on every hand in opposition to the bacteriological nature of the disease. For, as already stated, Schmidt–Rimpler[20] set up a new theory, that the ciliary nerves in the injured eye reflexly disturbed the circulation in the other eye; hence its nutrition, and thus preparing a soil for the

inflammation-producing substances which were carried to the eye by the circulation.

Deutschmann also felt called upon to defend his theory, and in a very lengthy publication[21] he gives the results of his further investigations. He states that though in his former experiments, numbering thirty-four, he had twelve positive results, equal to 30 per cent., in the last two years in thirty-five experimental investigations he has had but two positive results. He further recites the remarkable case, which occurred in his own practice, of a man who came to him with a well-developed case of sympathetic ophthalmia subsequent to an operation made to better his vision. While under observation the man died of, presumably, a cancer of the stomach, and he obtained permission to take the entire visual apparatus—both eyes, optic nerves and chiasm—intact. As a result of his bacteriological investigations he was enabled to demonstrate the bacteria in the first eye, its optic nerve, the chiasm, the second optic nerve, the lymph space and in the second eye. This is the only case on record in which the entire tract could be examined in man, and it is certainly of great value, and gives special emphasis to the bacteriological origin of the disease.

REPORT OF A CASE.

In April, 1894, through the courtesy of Dr. C. R. Holmes, the opportunity was given me to investigate, and, if possible, prove the Deutschman theory.

Bridget T , age sixty-four, was operated at the Cincinnati Hospital for senile cataract. The extraction was made, with every possible care to asepsis and antisepsis, no mishap occurring at the time of operation. After the operation the patient was placed in a mixed ward (where patients suffering from various diseases are kept); the eye did badly, and was lost by panophthalmitis. She passed from observation, and six months later presented herself at the doctor's office with a well-developed plastic irido-cyclitis of the other eye. The iris was bound down by a ring synechia and the pupil filled with a plastic ex-

udate. There was a great deal of ciliary injection, eyeball exceedingly painful and tender to the touch. The first eye likewise was inflamed, tender to the touch, totally amaurotic, and shrunken. An immediate enucleation was done on April 16, 1894, and the globe at once placed in Müller's fluid for microscopical examination. Six days later an iridectomy was made on the right eye (the second affected), the conjunctiva having previously been sterilized with a 1:1000 sublimate solution, followed by a saturated boracic acid solution. A broad incision was made with a Graefe knife and the aqueous at once aspirated from the anterior chamber with a very long, thin glass pipette (shaped like a pair of iris-forceps, and made on the same principle as the droppers in the German drop-bottles), which had previously been sterilized in steam for one-half hour, no antiseptic being taken up previously in the pipette. The drop of aqueous was at once inoculated on a tube of gelatin, and on the following day placed in a warm chamber having a constant temperature of 37.2° C. The following day a culture was made from this tube on an agar tube, but both of these tubes remained sterile at the end of four days, thus proving (1) that it is possible to draw off the aqueous from the anterior chamber without getting an infection from the conjunctiva or getting an infection of the tube direct; (2) that in this case at least Deutschman's idea of finding the germs in the aqueous of the second eye, notwithstanding a very marked sympathetic ophthalmia, was not realized.

After the iridectomy was made the eye was bandaged, but some chemosis followed, no doubt due to the use of the strong sublimate solution. The wound healed kindly, but the space of the iridectomy filled up with plastic material, and the eye has since been hopelessly lost.

The microscopical examination of the enucleated eye showed all the characteristic degenerations which follow panophthalmitis.

In the bacteriological examination specimens were stained with methyl blue and by the Gram's method, and, though fully one hundred sections were examined with the most painstaking

care, only a few of the pus-formers could be demonstrated in the interior of the eye. In one section they were found in the tissue of the ciliary body, but the section was mislaid and could not be found again. Both staphylococci and streptococci were found in the purulent exudate in the anterior chamber and vitreous; but long-continued search failed to find a single germ in the sub-vaginal lymph space. Hence, in this case micro-organisms could not be demonstrated either in the sub-vaginal lymph-space or in the aqueous of the second affected eye, two of the main factors on which this theory rests.

As long ago as 1840 Von Graefe made the emphatic statement that "where an eye is lost by suppuration this is not to be looked upon as a misfortune, since sympathetic ophthalmia of the second eye has never been observed where the first had been lost by suppuration." Panophthalmitis is the severest form of infection, and it was supposed that the severity of the inflammation blocked up all the channels of exit, and held the germs within the eyeball. True, panophthalmitis rarely leads to sympathetic ophthalmia, *but it can do so.* The cases on record are not a few in which, years after an apparently successful operation, the operated eye suddenly became inflamed, underwent a chronic inflammation, and in course of time sympathetic disease of the second eye followed.

As long ago as 1878 Leber[22] showed that where the iris, ciliary body, or even the capsule of the lens, cicatrize in the wound they give rise to slight differences in niveau, the formation of slight nodules, the epithelial covering of these is very apt to be stripped off.

Now, should a microbe infection occur, the condition is produced which leads to inflammation. This has been conclusively proven by the further investigations of Wagenmann,[23] who has shown that microbes gain entrance along fistulous tracts years after an apparently successful operation. For this very reason the operations of iridodesis, tattooing and drainage were abandoned. The evil results which followed reclination and discission were largely due to the use of non-sterile instruments. The same may be said of the operations for cataract

and iridectomies. One must not forget the fact that the infection can also be carried from an infected conjunctiva or non-surgically clean dressings. It is certainly a deplorable condition where both eyes are lost at the same time, but to the surgeon it surely must be more deplorable to lose the second eye as the result of an injury of the first, especially when an operation done on the first to save this not only fails, but in the course of time involves the second.

As long ago as 1856 Von Graefe reported four cases of sympathetic ophthalmia following reclination. This fact eventually brought the operation into disrepute, and led to the flap operation, and this, in its turn, to the linear extraction. Becker[24] considered this of such great importance that he devoted a separate chapter to its discussion. He critically analyzed some twenty-two cases, and finally concluded that the tension of the cicatricial bands on the ciliary body led to chronic irritation and sympathetic ophthalmia. Many of these earlier experiences read in the light of our present understanding of the subject are clearly an infection.

Formerly it was supposed that tumors could give rise to sympathetic ophthalmia. Here, evidently, there must have taken place either previously or subsequent to the formation of the tumor a perforation thus opening the door for an infection. Dr. Nieden,[25] of Bochum, reported a case of sympathetic ophthalmia in a young lady of twenty one years. She had been seen some time previously and a diagnosis of detachment of the retina made; some months later she returned with sympathetic ophthalmia. The first eye was enucleated, and the doctor states positively that the eye had never been perforated in any way. The enucleated eye was sent to Deutschman for microscopical examination and disclosed a spindle-celled sarcoma. It also contained micro-organisms to which he ascribes the inflammation in the other eye. Deutschman reported a similar case in 1889, as did also Brailey[26] in 1890, and at the Berlin International Congress Brailey drew especial attention to these tumors, and used this fact as an argument against the migration theory.

Schirmer, in his work already quoted, suggests that the only other method which could cause sympathetic ophthalmia would be that the sarcoma produces a phlogogenetic substance, and thus causes the disease, in the same manner as Leber supposes that brain tumors produce a toxine which leads to papillitis; or the infection might be endogenous; or, finally, this might simply have been an incidental complication.

A case which has direct bearing on this subject was reported by Dr. F. Pincus.[27] An eye, which had been amaurotic for fourteen years, becoming painful, the individual applied at the clinic at Jena for relief. The diagnosis "luxatio cataractæ iridodialysis" was made, the extraction followed, and, against the advice of the physician, the eye still being slightly inflamed, he left the clinic on the nineteenth day. Two months later he returned with a pronounced case of sympathetic trouble. The first eye was enucleated, and examination revealed the astounding fact that the eye contained in its upper segment a calcareous cysticercus, with hooklets present, and this had evidently led to the loss of vision some fourteen years previously. The wound following the operation had not healed perfectly, and examination for bacteria showed that micrococci and bacilli had entered at the cicatrix, and these could be followed into the optic nerve sheath, even into Tenon's space, more especially, however, in the region of the cicatrix and posteriorly at the entrance of the optic nerve. Dr. Pincus concludes that it is unreasonable to suppose that the operative insult to the ciliary body, in which an irritant was already present, could lead to a reflex transference to the other eye. The micro-organisms in the cicatrix, the interior of the eye, and in the lymph sheath led to sympathetic ophthalmia. He also describes a case following a cataract extraction in which he conclusively proved the presence of micro-organisms in the cicatrix and in the lymph space. Both cases demonstrate the truth of Deutschman's theory.

But undoubtedly the great majority of cases result from perforating wounds, with or without the retention of a foreign body. There can hardly exist a doubt to-day that it is not the

wound but the *infection* which leads to the disease. Should the wound be the result of a stab with a knife blade, a puncture with a knitting needle, a small branch of a tree, a cow's horn, or even a severe contusion and perforation by a block of wood, most naturally, if the injury is great, enucleation is evident; but when the injury is slight or posterior to the ciliary body it becomes a matter of no small consequence to decide what shall be done. Should one temporize until the inflammation develops—frequently the hæmorrhage into the anterior chamber, a traumatic cataract or a hæmorrhage into the vitreous, obstructs one's view, and as we have seen the micro-organisms are carried into the eye, reach the lymph circulation, reach the optic nerve sheath, and now—even though an enucleation be made, it comes too late, and we are helpless to stay the involvement of the second eye. True, if the media are clear, if the eye does not react violently, heals rapidly and becomes pale, it is fair to assume that no infection has taken place. But whenever an infection has taken place there should be no hesitancy as to how to proceed.

But where the foreign body has been retained (usually this is a minute piece of iron, steel, lead, copper or glass), Schirmer seems to believe that the danger of foreign bodies in the eye has been greatly overestimated. It is a well known fact that aseptic fragments of steel, even stone, may become encapsulated and remain perfectly latent for years. However, it may also be stated that even these capsules lead to tension on the vitreous, and in course of time to its destruction and eventually to the loss of the eye. Leber,[28] in his book, has proven that all the above-named substances, even gold and silver, are gradually acted on by the fluid media of the eye, minute quantities gradually dissolved off, and this acts as an irritant, causing a purulent inflammation which may be aseptic in its nature. He lays particular stress on the fact that aseptic pus may develop in the human eye, and considers the recognition of this fact as a great step forward and of the greatest therapeutic value. Formerly the general opinion prevailed that all such eyes containing pus ought to be enucleated at

once, but after it was shown that sympathetic ophthalmia is an infection, hence one is justified in trying to save an eye, provided one can show to a certainty that the pus is of aseptic origin. Hence, such conservative action is to be restricted to cases in which the formation of pus is restricted to the immediate neighborhood of the foreign body and the symptoms of a general inflammation are wanting, and, *above all*, if cultures of the exudate prove the absence of micro-organisms. However, should micro-organisms prove to be present, notwithstanding the successful extraction of the foreign body, the subsequent enucleation is indicated; whereas, if microbes are found wanting, one may attempt to save the eye, at least as long as the clinical course justifies it.

The shortest interval which has been noted to elapse between the injury and the involvement of the second eye has been placed at two or three weeks. To quote Schirmer once more the shorter the interval, the less the probability that the disease is due to an intercurrent affection, whereas the longer the interval the greater does the probability become. In many of the cases reported the statement is made that the first eye was not inflamed, for without irritation and inflammation of the first eye there can be no sympathetic inflammation of the second.

The attempt has been made to explain the occurrence of serous and plastic disease of the uveal tract in the second eye, instead of a purulent infection, on the hypothesis that the germs which reach the second eye are attenuated,[29] and have lost much of their virulence, so that they no longer lead to the formation of pus, but rather to a chronic inflammation, with the production of plastic, and later on to the formation of connective-tissue bands. As yet no specific micro-organism has been found. Streptococci, staphylococci and even short bacilli have been found, and no doubt this infection is a mixed one, and *any of the pathogenic germs which produce ptomaines and virulent toxines can produce sympathetic ophthalmia.*

The papillitis and retinitis which have been observed in the second eye are no doubt due either to the diffusion of tox-

ines, which precede the arrival of the microbes, in their descent along the lymph space surrounding the optic nerve of the second eye, or to the direct involvement of the nerve in the inflammatory process by the direct action of the germs on the same; whereas, the uveitis only comes on after the germs have been carried into the uveal tract. Therefore, as a result of our investigations, we are forced to admit that *sympathetic ophthalmia is an infection of the second eye, the result of an infection of the first*, the micro-organisms being carried or propagated along the sub-vaginal lymph space of the optic nerve sheath to the chiasm, and thence down the lymph space of the second optic nerve sheath to the second eye. Further, *every perforating wound*, be this the result of accident, operative procedure or pathological conditions, the result of disease, accident or operation (such as perforating corneal ulcerations, cystoid cicatrization, or staphylomata with formation of fistulous tract, etc.), *opens the door for the entrance of pathogenic microbes, without which there can be no sympathetic ophthalmia.* Deutschman has given this disease a better name, *ophthalmia migratoria.*

This forces us to admit that sympathetic ophthalmia and sympathetic neurosis are two fundamentally different diseases; whereas, the former is an infection, the latter is simply a neurosis. Further, whereas, the removal of an amaurotic eye for sympathetic irritation relieves the irritation, the removal of an eye for developed sympathetic ophthalmia will not influence the course of the disease in the second eye.

It should not be forgotten that sympathetic ophthalmia has been known to develop *after* an enucleation, the infection having reached the lymph space before the enucleation. Hence, *all treatment must have as one of its prime objects the prevention of an infection. After an eye has once been infected, the prime indication should always be to prevent an infection of the second eye.*

In conclusion the following rules as to treatment are suggested:

1. If the injury is severe and extensive, enucleate at once.

2. If the injury is slight, await developments, keeping the patient under observation; and if irido-cyclitis or purulent inflammation sets in, enucleate at once.

3. If a foreign body is lodged in the eye, (*a*) if it can not be extracted, enucleate; (*b*) if successfully extracted, determine if it is aseptic- if not aseptic the subsequent enucleation is indicated.

4. If the case comes under observation with sympathetic disease developing, (*a*) should the exciting eye be totally blind, enucleate; (*b*) should the exciting eye still possess some vision, do not enucleate, for experience has proven that, as a rule the second eye is hopelessly involved, and the only vision left may be in the first affected eye.

BIBLIOGRAPHY.

1. Klinische und Pathologische anatomisch Studien zur Pathogenese der Sympathische Ophthalmie, Graefe's Arch., Bd. 4, 1892

2. Practical Treatise on Diseases of the Eye, London, 1844.

3. Anatomische Beiträge zur Ophthal., Graefe's Archiv., vol. iv, 2, 1858.

4. Klinische Beobach ungen, Wiesbaden.

5. Vorträge aus dem Gesamtgebiet der Augenhe lkunde; Die Sympathischen Augenleiden, Weisbaden, 1881.

6. Volkmann'sche Sammlung klinische Vorträge, 1880.

7 Bemerkungen über die entstehung der Sympathischen Augenerkrankung, Graefe's Arch., xxvii, Bd. 1.

8. Discussion of Sympathetic Oph., Bd. iii, 1881.

9. Ueber die Ophthalmia Migratoria, Hamburg and Leipzig, 1889.

10. Graefe's Archiv., Vol. xxvii, Bd. 1, p. 340.

11. AMERICAN JOURNAL OF OPHTHALMOLOGY, July 15, 1884.

12. Knapp Schweigger's Archiv., xvii, p. 14.

13. La Riforma Medica, Agosto, 1887.

14. Discussion: Braily on Sympathetic Ophthalmia, X International Congress at Berlin, Vol. iv, p. 109, 1890.

15. Untersuchungen über Sympathische O., Arch. für Experimentelle Path. und Pharmacologie, xxvii, p. 153, 1890.

16. Discussion zum Vortrage von Secondi cura del Migratorii, XII Congress del Apoc Opth. Itali, 1891.

17. Ein Beitrag zur Pathogenese der Sympathische Ophthalmology; Experimentelle Studie, Arch. f. Augenheilkunde, xxi, p. 159, 1890.

18. Bericht über die xxi Vers. d. Opth. Ges. zu Heidelberg, p. 15, 1892.

19. Klinische und Pathologische anatomische Studien zur Pathogenese der S. O., Graefe's Arch., Vol. xxxviii, Bok iv, 1892.

20. Beiträge zur Ätiologie und Prophylaxe der Symp. Opth., Arch. für O., Vol. xxxviii, i, p. 199.

21. Beiträge zur Augenheilkunde, x Heft, 1893, Fortgesetzte Versuche und Untersuchungen über die Ophthalmia Migratoria.

22. Ueber die Intercellular Lücken des vordern Hornhaut Epitheles in normalem und pathologischem Zustande, Graefe's Arch., xxiv, p. 24, 1878.

23. Ueber die von Operations-narben und vernarbten Iris-vorfälle ausgehenden Glaskörper Eiterungen, Graefe's Arch., xxxv, Bd. iv, p. 110, 1889.

24. Pathology and Therapy of the Lens, Graefe Saemisch, vol. v, 1875.

25. Transactions of the Eighth International Congress of Edinburg, 1894.

26. Intra-Ocular Sarcoma Exciting Sympathetic Disease, Ophthal. Hospital Reports, xi, p. 43, 1887

27. Anatomischer Befund zwei sympathisirenden Augen, darunter eines mit Cysticercus intraocularis, Graefe's Arch., xl, 231, 1894.

28. Die Entstehung der Entzündung und die wirkung der entzündungserregenden Schädlichkeiten, Leipzig, 1891.

29. Sattler, Ophthal. Congress, Heidelberg, 1888.

—*Cincinnati Lancet-Clinic.*

PRELIMINARY REPORT ON SIX HUNDRED AND TWELVE CASES OF CONVERGENT SQUINT, WITH SPECIAL REFERENCE TO THE RESULTS OF OPERATION.[1]

BY CHARLES STEDMAN BULL, M D., NEW YORK.

Carefully tabulated statistical reports of the results of operations undertaken for the care or improvement of convergent squint have formed but little part of the ophthalmic literature of the last fifty years; and this fact has produced in the minds of the profession at large, and especially in the minds of some ophthalmologists, the feeling that the operation of tenotomy for the cure of squint is of doubtful value in many cases. The absence of useful, working statistics on this point has, no doubt, been largely due to the fact that it is extremely difficult to follow out these cases for a sufficiently long time after the operation, because the patients are so easily lost sight of,

[1]Abstract of a paper read before the American Ophthalmologieal Society, July 17, 1895.

especially if they be hospital cases, and if the first operation has proved only partially successful.

The feeling that operative procedures for the cure of squint are of doubtful value in many cases arises largely from the discrepancy in our ideas as to what constitutes a "cure" of convergent squint. If by "cure" is meant merely the removal of all visible disfigurement, with apparent restoration of parallel axes of the eyes, then the results of operation should be deemed very satisfactory. But if something more is meant, and we understand by the word "cure" not only the apparent restoration of parallel axes, but the improvement of vision in the squinting eye, the establishment of binocular vision, and the ability of the patient to use the eyes for all purposes, except close work, without correcting glasses, then our ideas of the value of tenotomy must be materially modified.

So wide is the difference of opinion among ophthalmologists as to the existing conditions in squint, the value of operative interference, and the nature of the operation which is to be done, that the writer has long held the view that the whole subject of strabismus is the least understood by modern ophthalmologists in the whole domain of ophthalmic science. We need but to glance over our text-books and the contents of our journals to be really convinced of the truth of this statement. Leaving entirely out of consideration the different views that are held as to the nature and causation of squint, there are many of our colleagues who question the wisdom of operating in early childhood, while others hold that in many instances no operation is necessary.

It is not the intention of the writer of this paper to enter into a discussion of the general subject of squint. The paper is intended to be merely a preliminary report on the effects of operative interference upon the condition of abnormal convergence of one or both eyes, including such other statistical details as may be necessary for a proper appreciation of the results obtained.

The entire number of 612 cases occurred in the private and hospital practice of the writer, and all the cases were care-

fully followed up and watched for a length of time varying from six months to ten years All examinations of the refractive and muscular conditions of these cases, all the various operations, and all subsequent observations were made by the writer himself. A much larger number of patients have been examined and operated on than the 612 here considered, but the cases could not be followed with any accuracy for a longer period than a few weeks, and hence they have formed no part of these statistics. Whatever conclusions may be drawn from these statistics must therefore be based solely on the 612 cases here tabulated.

No cases of a person under six years of age has been included, owing to the difficulty of testing the refraction and of obtaining anything like an accurate idea as to the existing acuity of vision in very young patients In all cases of equal or approximately equal refraction, full correction by glasses was ordered immediately after the operation, and these glasses the patients were directed to wear constantly for a varying length of time. The faithfulness with which these directions were carried out varied with the frequency with which the patients were subsequently seen, and the length of time they were under observation. When the refraction differed markedly in the two eyes, full correction for the non-squinting eye and partial correction for the squinting eye was ordered, and in some instances the strength of the latter glass was increased as time elapsed.

The cases were about equally divided between the sexes, there being 304 males and 308 females.

The refraction was in the great majority of instances hypermetropic, these statistics agreeing on this point with all previous statistics hitherto published. The refractive condition of the 612 cases was as follows:

Simple hypermetropia in 521 cases.
Simple hypermetropic astigmatism in 24 cases.
Compound hypermetropic astigmatism in 34 cases.
Simple myopia in 13 cases.
Simple myopic astigmatism in 3 cases.

Compound myopic astigmatism in 2 cases.

Emmetropia in 15 cases.

There were 57 cases of anisometropia and 2 cases of amblyopia.

The 15 cases of emmetropia were so regarded because, while under the influence of atropine, the vision for twenty feet was made perceptibly worse by a glass of + D. 0.50, whether spherical or cylindrical.

A Study of the tables showing the degree of refraction in each case gives some interesting data.

The 579 cases of hypermetropic refraction were divided as follows:

Under D. 1, in one or both eyes, 27 cases.

Between D. 1 and D. 2, in one or both eyes, 205 cases.

" D. 2 and D. 3, " " " 147 "

" D. 3 and D. 4, " " " 95 "

" D. 4 and D. 5, " " " 76 "

" D. 5 and D. 6, " " " 51 "

" D. 6 and D. 7, " " " 20 "

" D. 7 and D. 8, " " " 5 "

" D. 9 and D. 10, " " " 1 case.

Over D. 10, in one or both eyes, 2 cases.

The cases of myopic refraction varied between D. 0.50 and D. 9.

Amblyopia or defective visual acuity was a very marked feature in the squinting eye, as might have been expected, but a study of the tables shows also a more or less decided subnormal acuity of vision in the fellow eye. The tables also show a by no means inconsiderable number of cases in which there was no loss of visual acuity in either eye.

There was defective vision in the squinting eye in 236 cases, or about thirty-seven per cent.

There was defective vision in both eyes in 291 cases, or about forty-eight per cent.

There was no amblyopia in either eye in 85 cases, or about fifteen per cent.

The tests for vision were made first without the use of

atropine, and subsequently the accommodation was paralyzed and the tests repeated in all cases, except where the age of the patient rendered it unnecessary.

The operative procedures employed in the treatment of these cases consisted of simple tenotomy of one internal rectus; tenotomy of the internal rectus of each eye at different periods; simultaneous tenotomy of both internal recti; tenotomy of the internal rectus of one eye and advancement of the external rectus of the same eye; tenotomy of the internal recti of both eyes and advancement of the external rectus of the squinting eye; and simultaneous tenotomy of the internal recti of both eyes, followed at a varying length of time by a second tenotomy of the internal rectus of the squinting eye.

Simple tenotomy of the right internal rectus was done in 72 cases.

Simple tenotomy of the left internal rectus was done in 92 cases.

Tenotomy of both internal recti at different periods was done in 18 › cases.

Simultaneous tenotomy of the internal rectus of both eyes was done in 20 cases.

Tenotomy of the right internal rectus and advancement of the right external rectus was done in 91 cases.

Tenotomy of the left internal rectus and advancement of the left external rectus was done in 131 cases.

Tenotomy of both internal recti and advancement of the external rectus of the squinting eye was done in 14 cases.

Simultaneous tenotomy of the internal rectus of both eyes and subsequent tenotomy of the internal rectus of the squinting eye was done in 6 cases.

The results of the various operations upon the degree of the squint were as follows:

Simple tenotomy of the internal rectus of one eye was done in 164 cases. The final result was:

Convergence in 102 cases, or about sixty-two per cent.

Parallelism in 55 cases, or about thirty-three and a third per cent.

In all cases of resulting convergence, the degree was much less than before the operation. No second operation in any one of these 102 cases was permitted.

Tenotomy of the internal rectus of both eyes at different periods was done in 186 cases. The final result was:

Convergence in 144 cases, or about seventy-eight per cent.

Parallelism in 33 cases, or about seventeen per cent.

Divergence in 9 cases, or about five per cent.

Simultaneous tenotomy of both internal recti was done in 20 cases. The final result was:

Convergence in 13 cases, or about sixty-six per cent.

Parallelism in 1 case, or about five per cent.

Divergence in 6 cases, or about thirty per cent.

Tenotomy of the internal rectus and advancement of the external rectus of the squinting eye was done in 222 cases. The final result was:

Convergence in 38 cases, or about sixteen per cent.

Parallelism in 178 cases, or about eighty per cent.

Divergence in 6 cases, or about two and four-fifths per cent.

Tenotomy of the internal rectus of both eyes and advancement of the external rectus of the squinting eye was done in 14 cases. The final result was:

Convergence in 3 cases, or about twenty-one per cent.

Parallelism in 9 cases, or about six per cent.

Divergence in 2 cases, or about fourteen and two-sevenths per cent.

Tenotomy of the internal rectus of both eyes, and subsequently a second tenotomy of the internal rectus of the squinting eye, was done in 6 cases. The final result was:

Convergence in 3 cases, or fifty percent.

Parallelism in 1 case, or about sixteen and two-thirds per cent.

Divergence in 2 cases, or about thirty-three and a third per cent.

The general percentage of final results was as follows:

Whole number of cases operated was 612.

Resulting *convergence* in 307 cases, or about fifty per cent.

Resulting *parallelism* in 277 cases, or about forty-five per cent.

Resulting *divergence* in 32 cases, or about five per cent.

In all cases in which convergence was the final result, the degree of convergence was decidedly less than that of the original defect.

A few words now in regard to the question of the supposed improvement in vision of the squinting eye

There was an improvement in the visual acuity of the squinting eye alone, after the operation, in 7 cases.

There was an improvement in the vision of the fellow eye alone in 65 cases.

There was an improvement in the vision of both eyes in 14 cases.

A somewhat careful study of these cases has led me to the conclusion that the instances of improvement in the visual acuity were undoubted, but that, while occurring *after the operation*, they could not be considered as *due to the operation*, but rather to the stimulating beneficial effect induced by wearing the full correction of the refractive error.

Complications.—A number of the cases were complicated by other lesions, the existence of which may have had some influence upon the final result after operation.

There were 30 cases in which there was more or less marked loss of power in the external rectus. In 6 of these cases the paresis of the muscle was due to diphtheria, and in 4 cases to falls upon the head. There were 9 cases of more or less marked blepharitis or blepharo-adenitis, all of which recovered after the operation and fitting with correcting glasses. There were 2 cases of strabismus sursumverges associated with the convergent squint, and in both the upward deviation disappeared after the operation. There were 18 cases of corneal opacity more or less distinctly marked.

In 7 cases the appearance of the squint had been immediately preceded by measles, and in 2 cases by scarlatina.

General chorea existed in 2 of the cases and rotary nystagmus in 8 cases.

In 8 cases the squint had followed an attack of epileptiform convulsions, and in 3 cases it occurred during an attack of pertussis.

The convergence was complicated in 2 cases by congenital ptosis; in 1 case by facial paralysis, and in 2 cases by encanthus.

In two of the myopic cases detachment of the retina occurred after the operation.

In four cases there was no fixation with the squinting eye either before or after the operation.

A cursory review of the final results of the operation on the degree of the squint would leave the surgeon to believe that the greatest effect is to be expected from tenotomy of the internal rectus and advancement of the external rectus of the squinting eye, and that the method of operating by simultaneous tenotomy of the internal recti of both eyes is the least valuable.

A more careful study of each case, however, has led the writer to the formulation of the following conclusions, which may be modified by lapse of time and a larger experience:

1. If the squint is in one eye and of the alternating variety, there is usually very little amblyopia in either eye and but little difference in the refractive error of the two eyes. In the majority of these cases free tenotomy of the internal rectus of the eye which usually squints, with immediate full correction of the refractive error, will give as a final result either apparent parallelism or such a slight degree of convergence as is not noticeable under the glasses.

2. If the squint is always in the same eye there is almost always a decided difference in the refraction of the two eyes and a decided amblyopia in the squinting eye. In these cases, if there is no loss of power in the external rectus, the best results are gained by tenotomy of the internal rectus and advancement of the external rectus of the squinting eye and subsequent full correction by glasses.

3. If there is marked amblyopia in the squinting eye and some loss of power in the external rectus of the same eye, the

best operation will be found to be tenotomy of the internal rectus and advancement of the external rectus of the squinting eye, and at a varying period later tenotomy of the internal rectus of the other eye. Simultaneous tenotomy of the internal rectus of both eyes and advancement of the external rectus of the squinting eye is not a desirable operation in these cases, as it too often leads to permanent divergence.

4. If, however, the squinting eye is markedly amblyopic and the external rectus of this eye is entirely paralyzed, the best results are gained by a simultaneous tenotomy of the internal rectus of both eyes and advancement of the external rectus of the squinting eye.

5. In the emmetropic cases, fifteen in number, the best results were gained by tenotomy of the internal rectus of the squinting eye, followed at a varying period by tenotomy of the internal rectus of the other eye. The reason for this is not as yet apparent.

6. There will always be a number of cases, by no means inconsiderable, in which it will be impossible to decide in advance what method of operating will be likely to give the best results, and in which what we do will be more or less a matter of guess-work.

7. Any complication which interferes with the visual acuity of a squinting eye, such as corneal maculæ, striæ in the lens, or extensive choroidal atrophy, must be regarded as pointing to the necessity of more extensive operative interference than simple tenotomy, even when no great refractive difference exists between the eyes and where no paresis of the external rectus is present.

In studying closely the statistics of a considerable number of cases of convergent squint, one of the lessons taught is that though defective vision is probably one of the causes of permanent squint, yet the results of the operation are satisfactory in a very large number of cases. Another fact that becomes evident is that in a by no means inconsiderable number of cases a tenotomy on the squinting eye is useless, and we are forced to do a tenotomy on the other eye.

Schweigger seems to be correct in saying that in the majority of these cases periodic squint is cured by a simple tenotomy, and that an imperfect result can be supplemented by tenotomy on the other eye.

The absence of fixation in the squinting eye in some cases of marked amblyopia renders it doubtful whether a satisfactory final result can be gained by any operation. Not a few cases may be found in the tables (presented with the paper at the meeting) in which only slight improvement was gained even by tenotomy of both internal recti and advancement of the external rectus of the squinting eye.

It should not be forgotten that a primary good result very often retrogresses, and surgeons do not sufficiently consider that the strength of the antagonistic muscle exerts a powerful influence on the ultimate result of the operation. Apparent loss of power in the external rectus does not always mean actual loss of power, and Schweigger has some reason for recommending gymnastic exercise of the muscles by alternately turning the eyes to the right and left as a useful preliminary to the operation for squint. It is a mistake to suppose that advancement of a muscle immediately brings about a permanent position of this eye, for, as in simple tenotomy, the immediate result never remains permanent, but usually diminishes somewhat, though it may may increase.—*New York Medical Journal.*